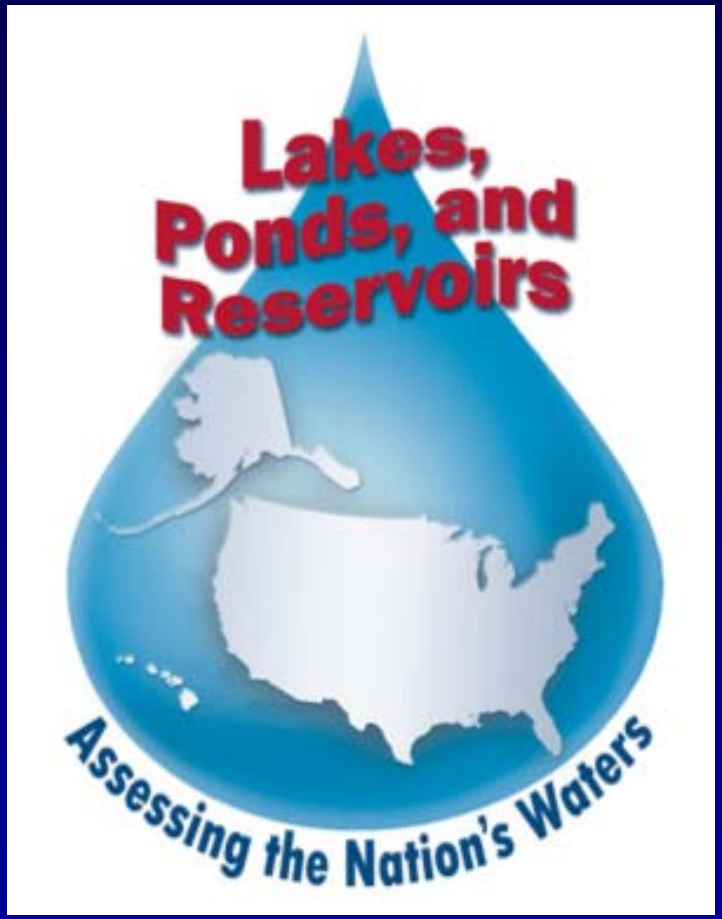
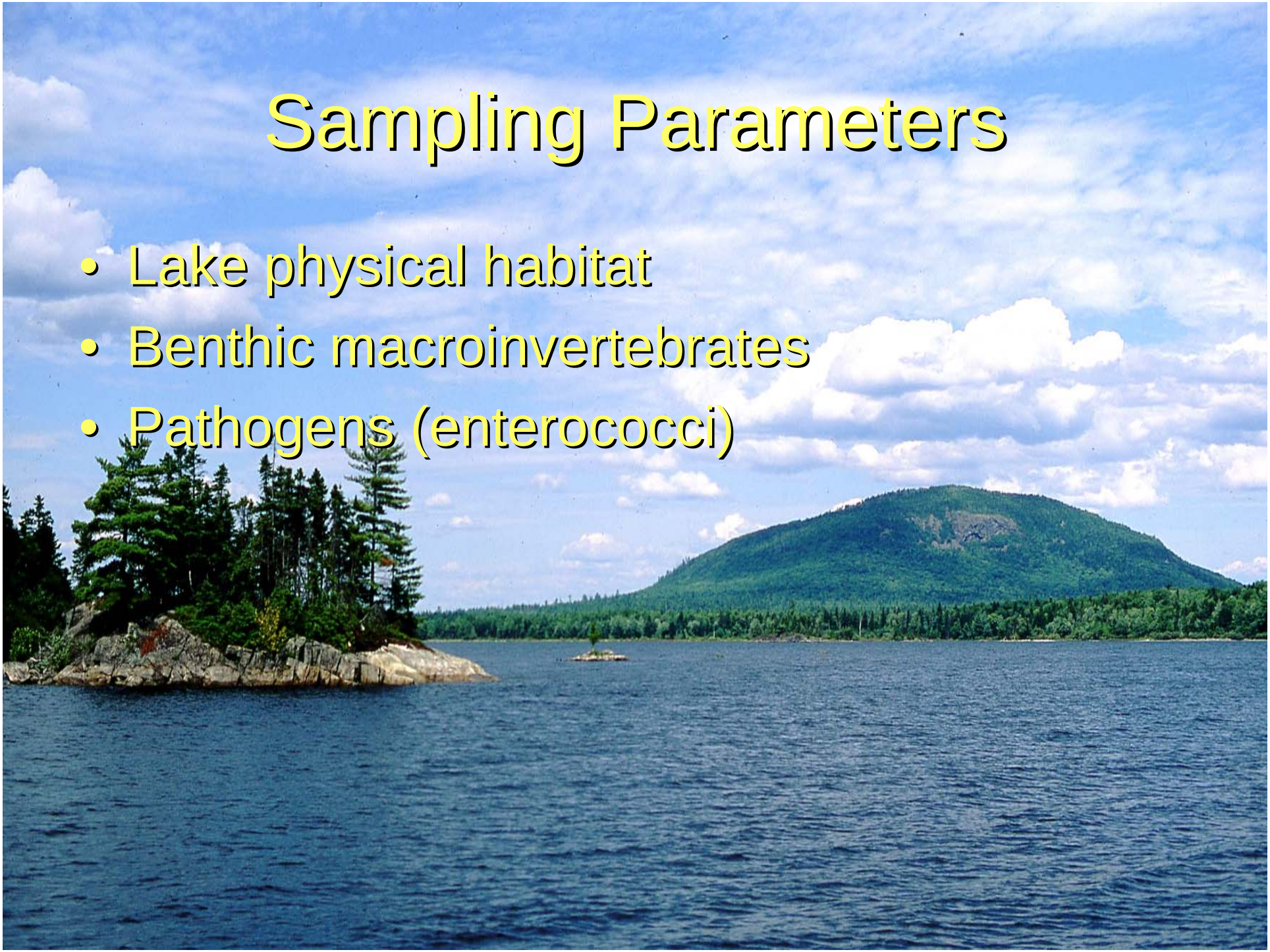
Survey of the Nation's Lakes Workshop



Littoral Zone Sampling

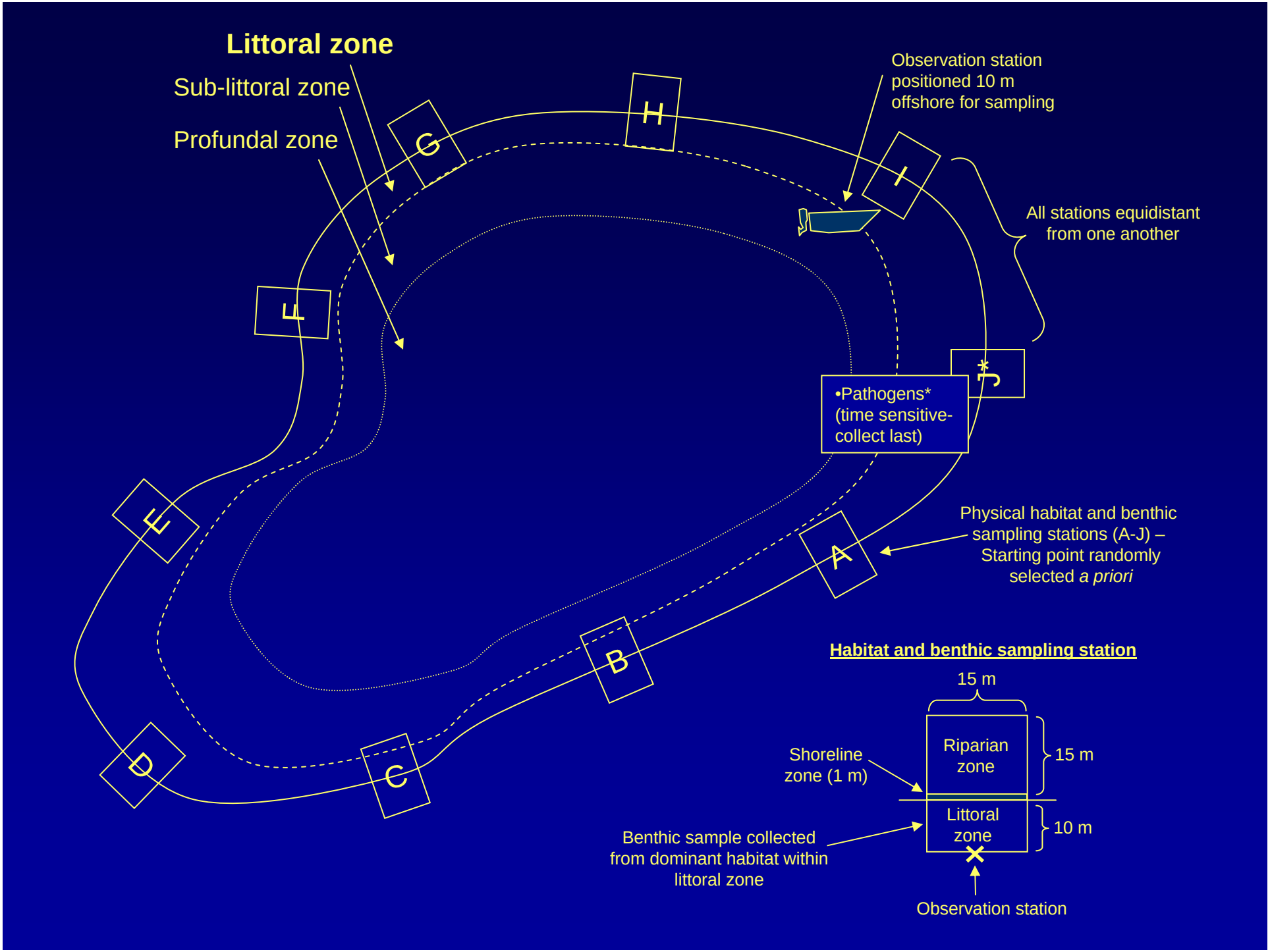
Overview

- Discuss parameters sampled from the lake perimeter (littoral zone)
- Describe sampling station selection procedures
- Describe sampling and processing methods for parameters

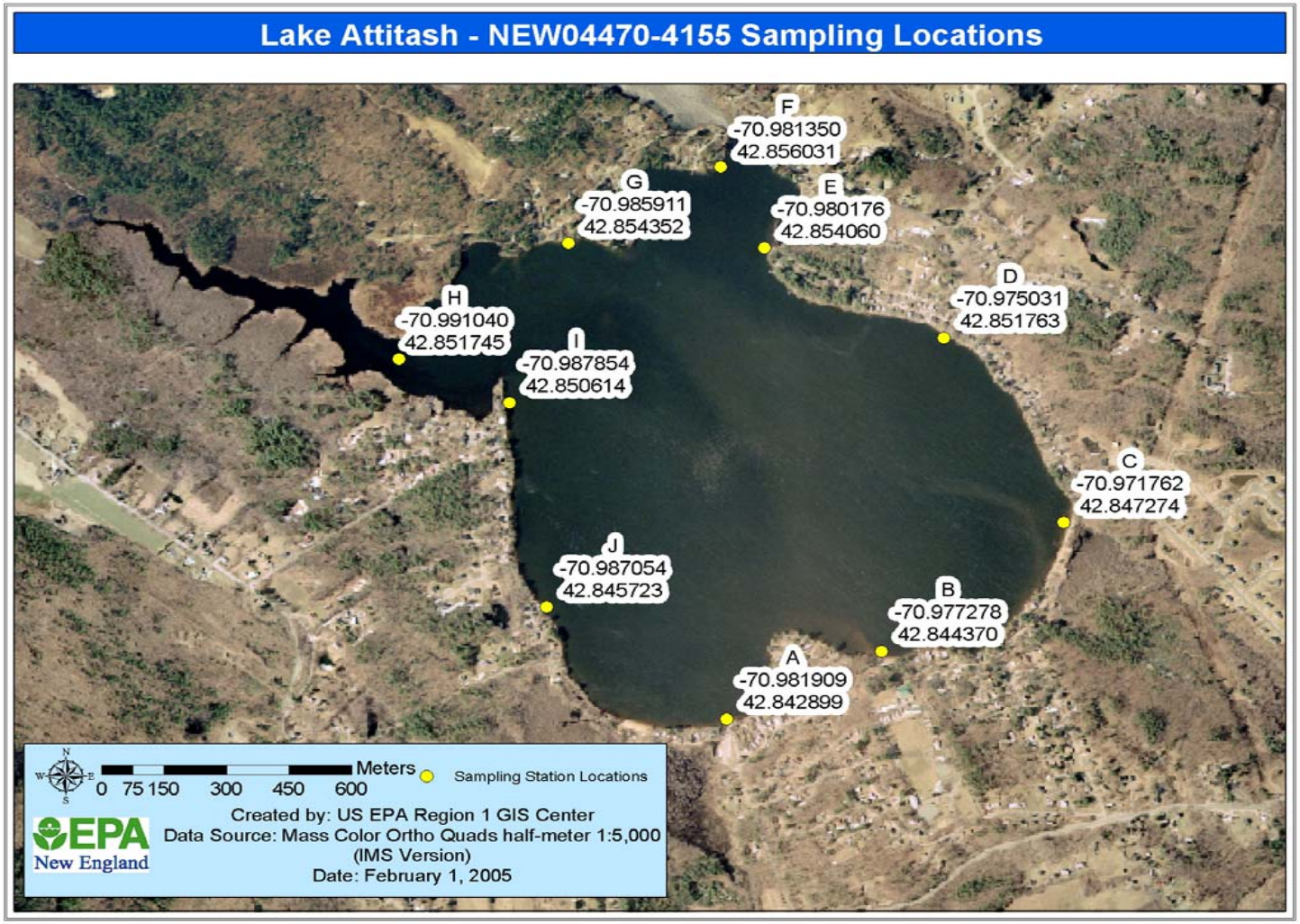


Sampling Parameters

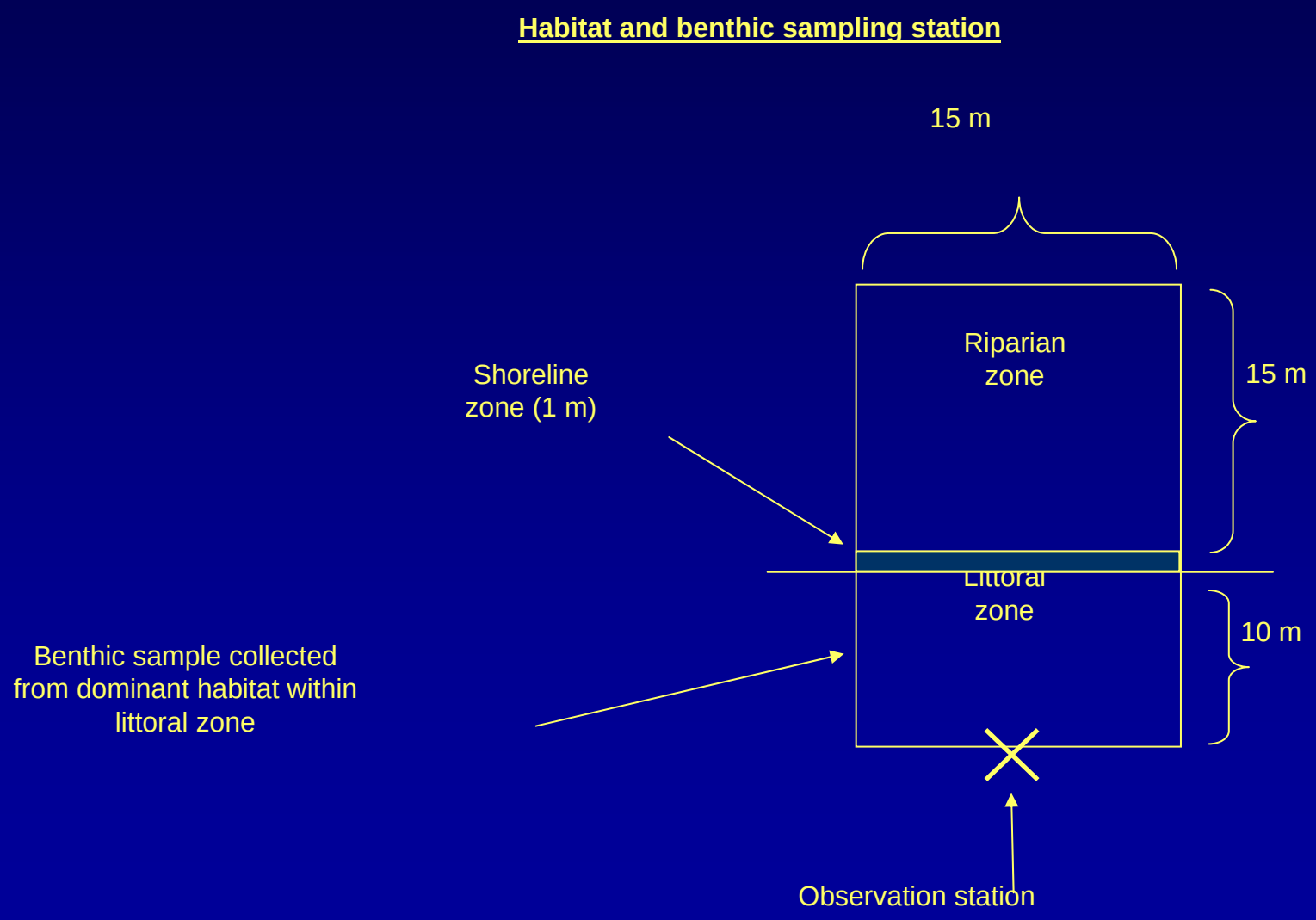
- Lake physical habitat
- Benthic macroinvertebrates
- Pathogens (enterococci)


Littoral zone
Sub-littoral zone
Profundal zone
Observation station positioned 10 m offshore for sampling
All stations equidistant from one another
•Pathogens* (time sensitive-collect last)
Physical habitat and benthic sampling stations (A-J) – Starting point randomly selected *a priori*
Habitat and benthic sampling station
15 m
Riparian zone
15 m
Shoreline zone (1 m)
Littoral zone
10 m
Benthic sample collected from dominant habitat within littoral zone
Observation station

Determining Sampling Stations Using GIS



Littoral Sampling Station Layout



Habitat Characterization

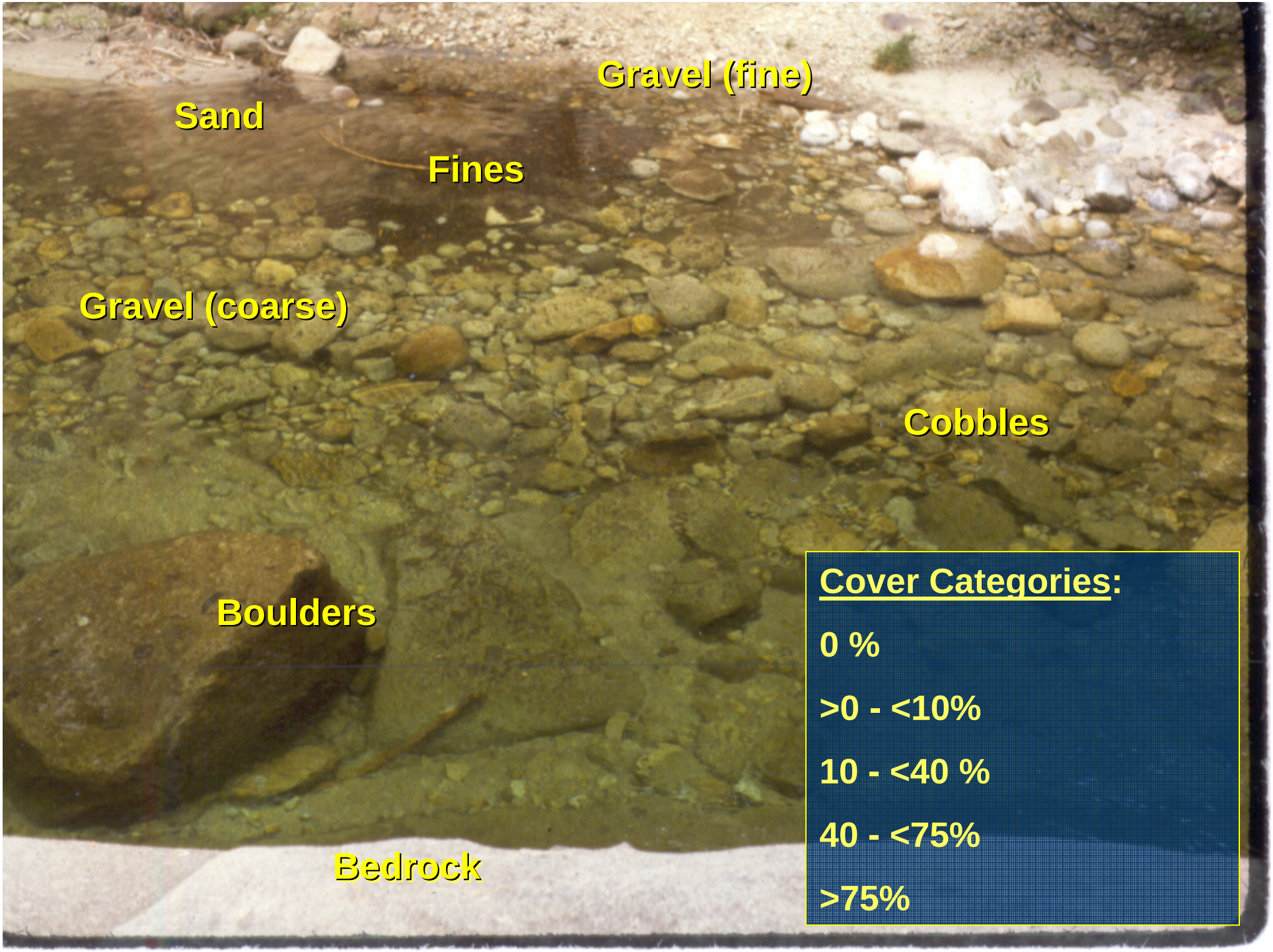
- Depth, Surface Char. & Level Fluctuations
- Substrate -- Bottom & Shoreline
- Littoral Aquatic Macrophytes
- Fish Cover
- Riparian Vegetation Structure & Cover
- Human Landuse & Disturbances

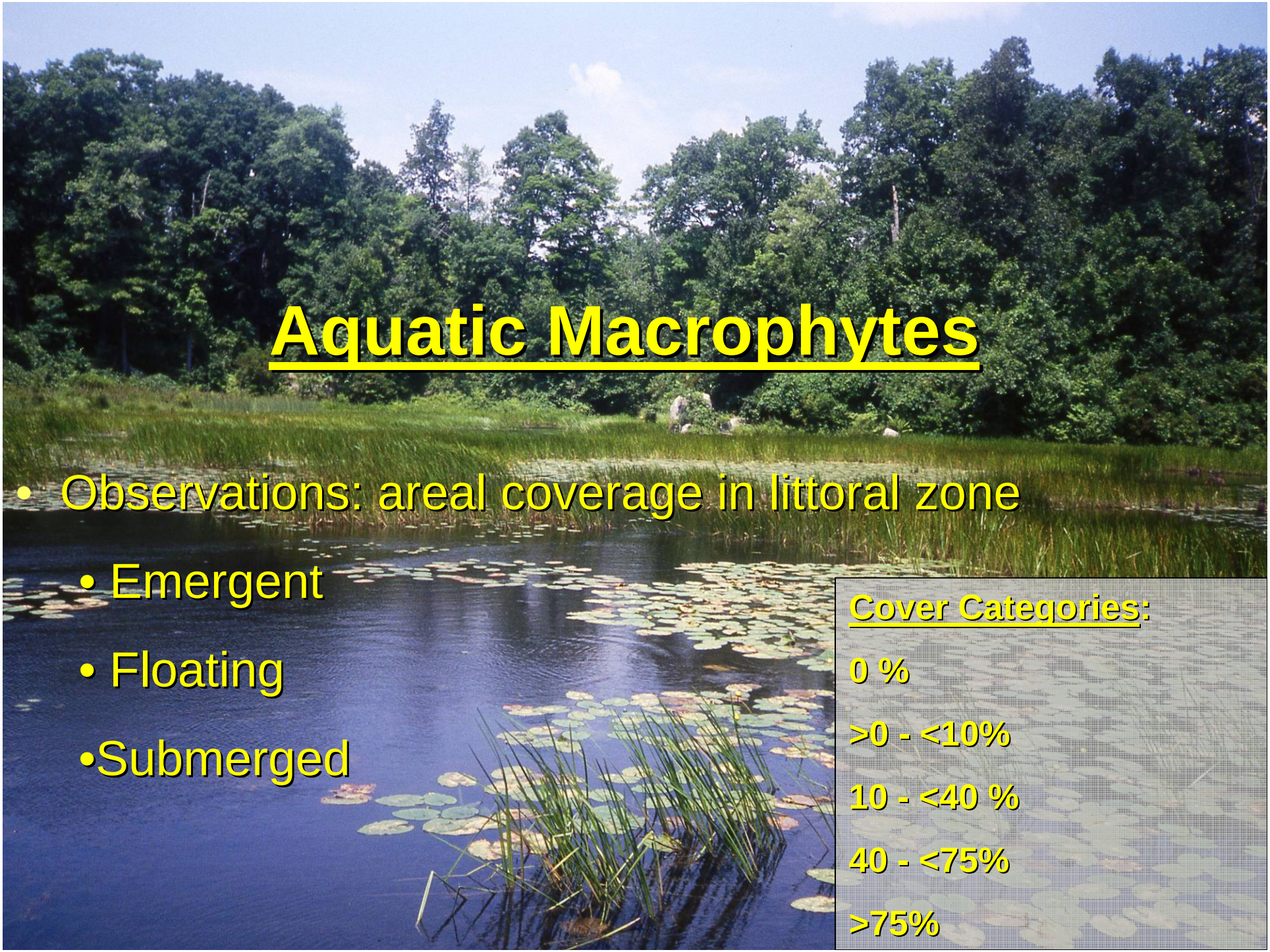
Depth, Surface, Banks, and Level Fluctuations

- Depth 10m offshore: sounding or SONAR
- Bank Angle – 3 Classes, vertical, steep or gradual
- Height and Extent of High Water Levels
- Presence/Absence of Algal Mat, Scum, Oil

Substrate

- Observations: visual, probe, sounding
- Separate estimates-- shoreline and littoral bottom
- 6 Size Classes plus Large Wood (Snags)


Gravel (fine)
Sand
Fines
Gravel (coarse)
Cobbles
Boulders
Bedrock
Cover Categories:
0 %
>0 - <10%
10 - <40 %
40 - <75%
>75%



Aquatic Macrophytes

- Observations: areal coverage in littoral zone
  - Emergent
  - Floating
  - Submerged

Cover Categories:

0 %

>0 - <10%

10 - <40 %

40 - <75%

>75%

Fish "Cover" (concealment features)

- Observations: visual, probe, soundings
- Boulder, Rock Ledge
- Snags, Brush
- Overhanging vegetation, Inundated live trees
- Aquatic macrophytes
- Human structures

Cover Categories:

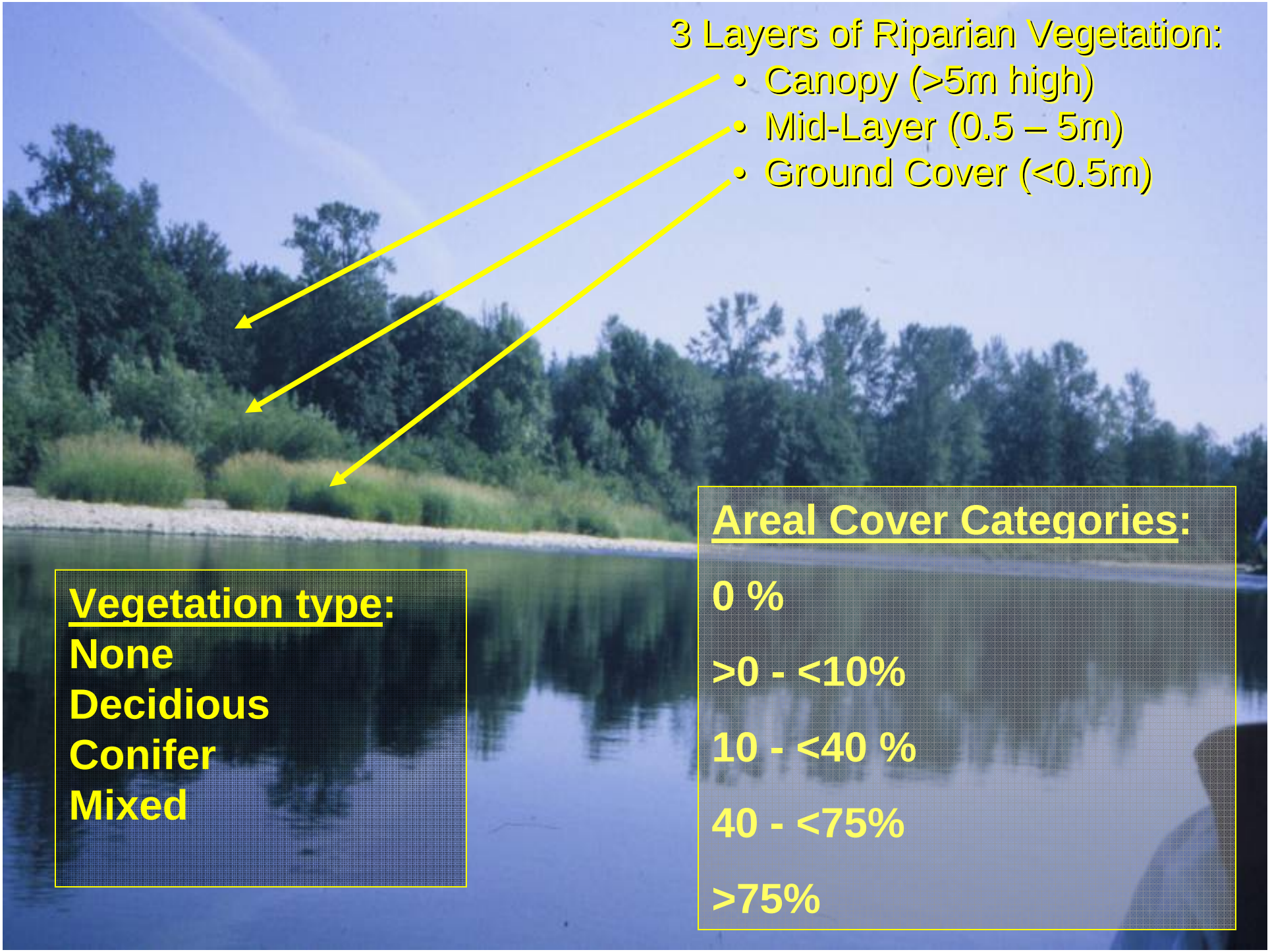
0= absent

1= present, but sparse

2= present with moderate to heavy density

Riparian Structure and Cover

- Vegetation Type and Visual Cover Estimates:
  - Canopy (>5m high)
  - Mid-Layer (0.5 – 5m)
  - Ground Layer (<0.5m)


3 Layers of Riparian Vegetation:
• Canopy (>5m high)
• Mid-Layer (0.5 – 5m)
• Ground Cover (<0.5m)
Vegetation type:
None
Deciduous
Conifer
Mixed
Areal Cover Categories:
0 %
>0 - <10%
10 - <40 %
40 - <75%
>75%

Human Activities & Disturbances

- Buildings
- Commercial/Industrial Developments
- Parks Facilities
- Docks/Boats
- Walls/Dikes/Revetments/Dams
- Litter/Trash/Landfill
- Roads/Railroads
- Row Crop Agriculture
- Pasture/Hayfield
- Orchard
- Lawn
- Other

Proximity Categories:

Within Plot

Adjacent or Beyond Plot

Absent

Why Physical Habitat?

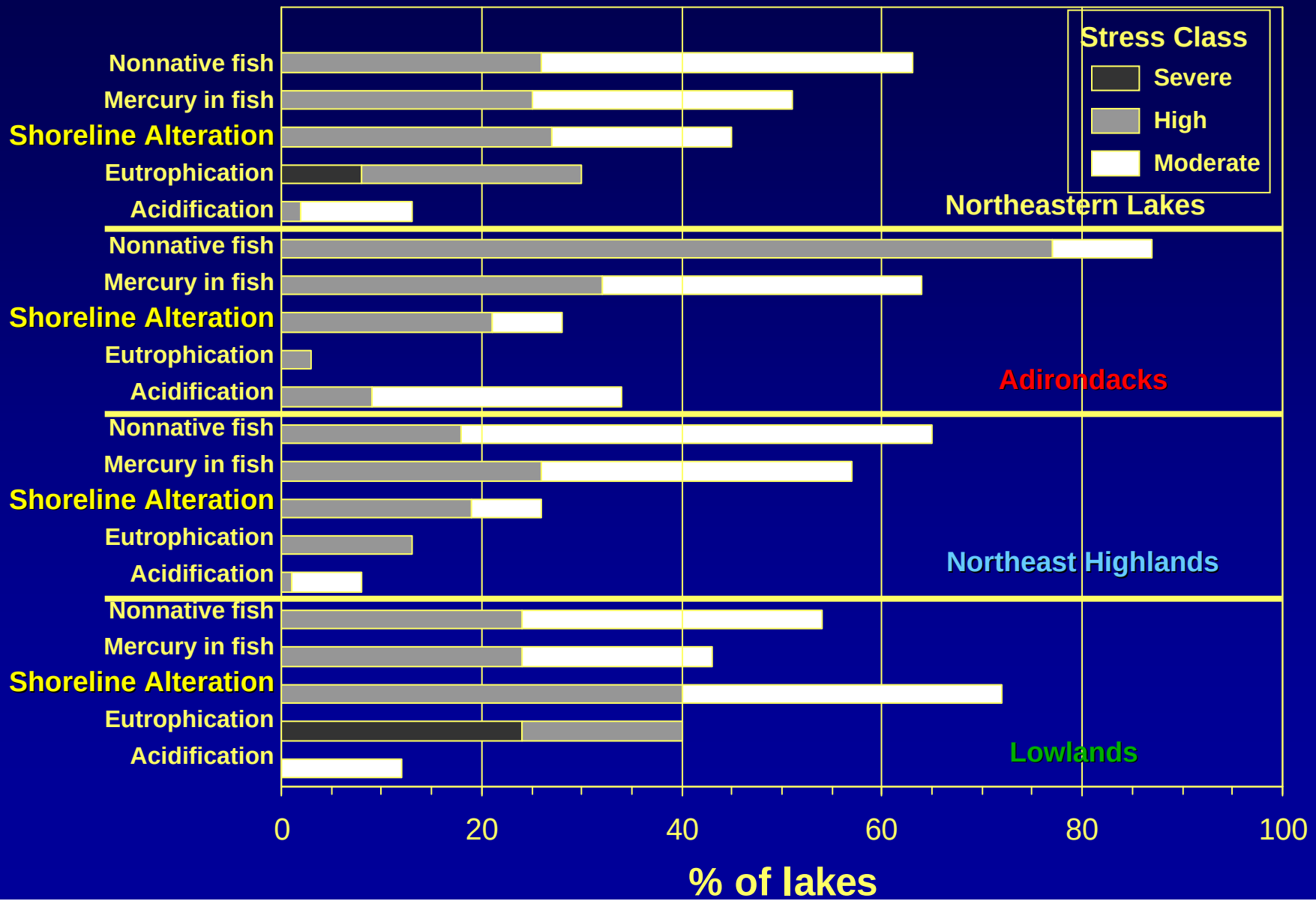
- Able to build composite indices from basic measures
  - **Riparian Development** = f (extent + intensity of human activities)
  - **Rip. Veg Qual** = f (layer complexity + canopy & midlayer presence + wetland cover)
  - **Littoral Cover** = f (Sum of Cover Types + Snags + Wetland Veg)

- Importance of shoreline alteration

*"……nonnative fish introductions, mercury contamination, and **shoreline alteration** ……. are as widespread as eutrophication, and more extensive than acidification, in the lakes of the northeastern [United] States…."*

from Whittier, Paulsen, Larsen, Petersen, Herlihy and Kaufmann. 2002. BioScience 52(3):235-247

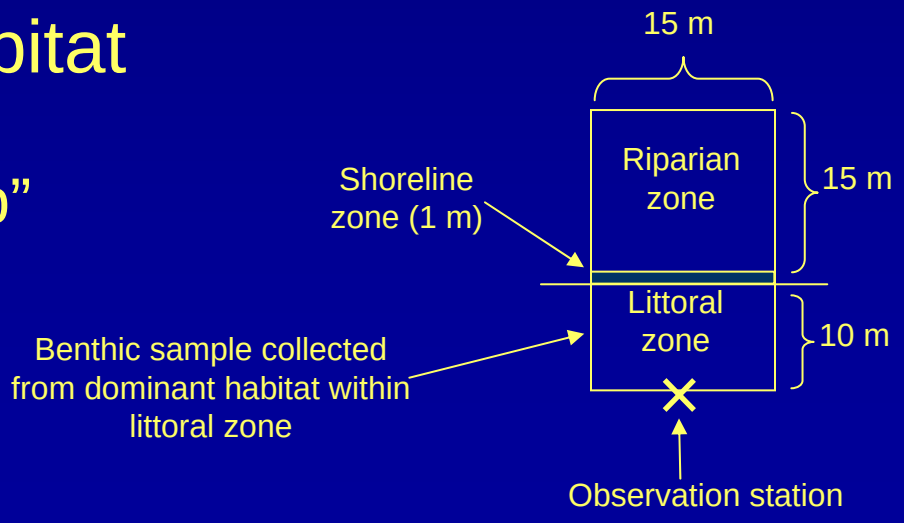
Comparison of Extent and Severity of Stressors in Northeastern Lakes



Benthic Macroinvertebrate Sampling

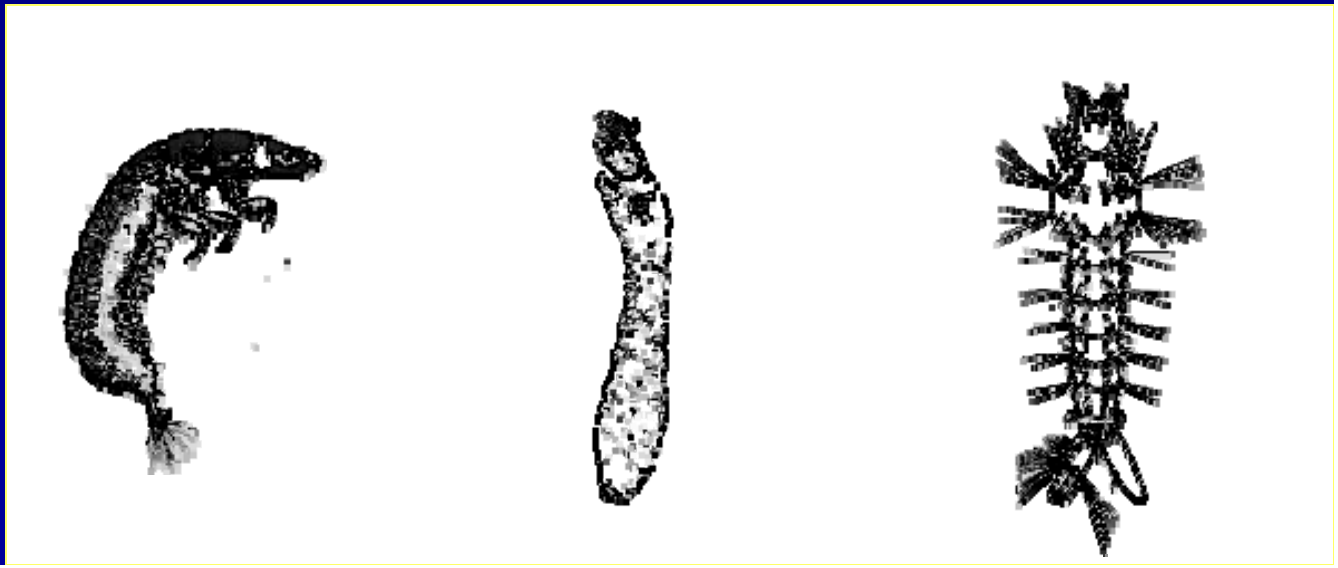
- Collected from dominant habitat type within littoral zone at each station:
  - rocky/cobble/large woody debris
  - Shorezone vegetation and/or submerged aquatic vegetation
  - organic fine muds or sand
- Composite of 10 multihabitat samples
  - Single 1 m “jab” or “sweep” with D-frame net (500 µm mesh) from each station

Habitat and benthic sampling station



Benthic Macroinvertebrate Processing & Analysis

- Composite sample sorted and subsampled to 500 (± 20%) organisms
- Specimens primarily identified to genus level
- Analyze data using existing or newly developed IBI



Why Benthic Macroinvertebrates?

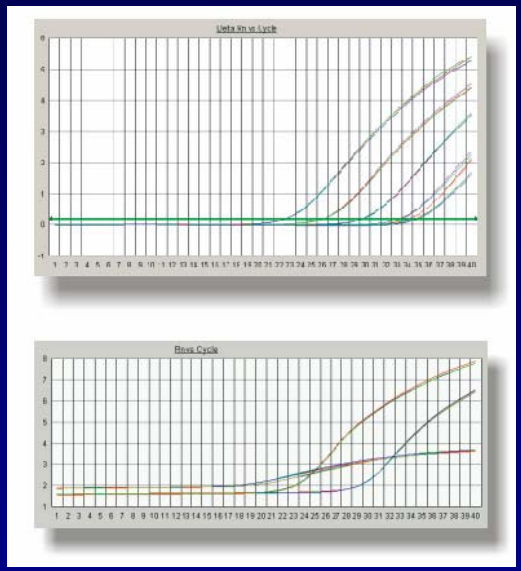
- Populations in the benthic assemblage respond to a wide array of stressors in different ways so that it is often possible to determine the type of stress that has affected a macroinvertebrate assemblage
- The structure and function of the macroinvertebrate assemblage is a response to exposure of present or past conditions

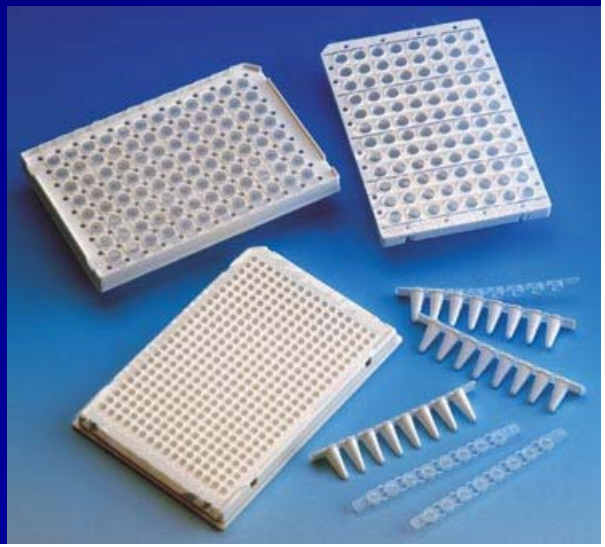
Pathogen (*Enterococci*) Sampling

- Sampled offshore of the final physical habitat station
- Collected in 1-L pre-sterlized, polypropopylene bottles at appropriate sampling depth (6-12 inches below water surface)
- Samples need to be filtered and frozen within 6 hours of collection

Enterococci Processing and Analysis

- Samples processed and analyzed using methods developed by the U.S. EPA National Exposure Research Laboratory (NERL)
- Analyzed using a Quantitative Polymerase Chain Reaction (QPCR) method
  - a genetic method that quantifies a DNA target via a fluorescently tagged probe





Why Pathogens?

- Provide an indicator of the proportion of lakes with levels of enterococci above levels of concern for recreational purpose
- Epidemiological studies demonstrate relationship between levels of enterococci and disease

Status

- Methods have been reviewed by states and tribes
- Most methods finalized, but some may be revised based on comments
  - Pathogen sampling, processing and analysis methods still under review
  - Physical habitat requirements for large lakes still in development
  - Bethinc sampling from littoral zone still under review
- All methods will be finalized by year's end

For more information about the Survey of the Nation's Lakes

- Visit our website:
  http://www.epa.gov/owow/lakes/lakessurvey/

- Questions or comments email us at:
  lakessurvey@epa.gov